Claims

What is claimed is:

1. A semilunar heart valve, comprising a biodegradable polymer fiber scaffold and collagen.

2. The semilunar heart valve of claim 1, wherein the biodegradable polymer fiber scaffold is a biopolymer fiber scaffold.

3. The semilunar heart valve of claim 1, wherein the collagen is porcine fetal collagen.

4. The semilunar heart valve of claim 1, wherein the collagen is fibrillar collagen.

5. The semilunar heart valve of claim 4, wherein the fibrillar collagen is liquid dense fibrillar collagen.

6. The semilunar heart valve of claim 2, wherein the biopolymer fiber scaffold is a collagen biopolymer scaffold.

7. The semilunar heart valve of claim 6, wherein the collagen is selected from the group consisting or collagen type I, collagen type II, collagen type III, collagen type IV, collagen type V, collagen type VI, collagen type VII, collagen type VIII, collagen type IX, collagen type X, collagen type XI, collagen type XII, collagen type XIII, collagen type XIV, and collagen type XVII.

8. The semilunar heart valve of claim 6, wherein the collagen biopolymer scaffold is crosslinked.

9. The semilunar heart valve of claim 1, wherein the biodegradable polymer fiber scaffold is derived from an aortic porcine valve processed without a crosslinking agent.

10. The semilunar heart valve of claim 1, further comprising signaling molecules.

11. The semilunar heart valve of claim 1, wherein the polymer scaffold has a structure determined by a digital program.

12. A method of making a semilunar heart valve, comprising the steps of:

(a) assembling a mold which replicates the structure of a semilunar heart valve having between two lateral edges a hollow representing the aortic root and hollows representing a plurality of leaflets with outer and inner surfaces, the inner surfaces of the hollows representing the plurality of leaflets connecting with the hollow representing the aortic root and forming the intimal surface of the hollow representing the aortic root;

(b) covering the intimal surface of the hollow representing the aortic root and the outside surface of the hollow representing the plurality of leaflets with a biodegradable polymer fiber scaffold;

(c) filling the hollow representing the aortic root and the hollows representing the plurality of leaflets with collagen; and

(d) freeze-drying the polymer fiber scaffold and the collagen forming a tissue with two lateral edges.

13. The method of making a semilunar heart valve of claim 12, wherein the biodegradable fiber scaffold is a biopolymer fiber scaffold.

14. The method of making a semilunar heart valve of claim 12, wherein the collagen is porcine fetal collagen.

15. The method of making a semilunar heart valve of claim 12, wherein the collagen is fibrillar collagen.

16. The method of making a semilunar heart valve of claim 12, wherein the collagen is enriched with signaling molecules.

17. The method of making a semilunar heart valve of claim 16, wherein the signaling molecules are selected from the group consisting of sonic hedgehog; NK-2, XNKx-3.3 (tinman), hCsx and Gax homeobox gene products; TGFbeta, VEGF, FGF, IGF, PDGF, and BMP4 cytokine proteins.

18. The method of making a semilunar heart valve of claim 12, further comprising the steps of removing the tissue from the mold, and sewing together the two lateral edges of the tissue.

19. The method of making a semilunar heart valve of claim 12, further comprising the steps of, seeding the tissue with cells which normally populate human semilunar valve tissue.

20. The method of making a semilunar heart valve of claim 19, wherein the cells are selected from the group consisting of fibrosa, spongiosa, and ventricularis cells.

21. The method of making a semilunar heart valve of claim 21, further comprising the step of culturing the cells.

22. The method of making a semilunar heart valve of either claim 12 or 19, further comprising the step of seeding the tissue with endothelial or mesothelial cells.

23. An annular sewing ring for attachment of a heart valve to the aortic wall of a host, comprising:

a biopolymer cloth and a biopolymer rope shaped in a circle, wherein the biopolymer cloth is wrapped around and stitched to the biopolymer rope.

24. The annular sewing ring of claim 23, wherein the biopolymer fiber cloth is collagen cloth and the biopolymer rope is collagen rope.

25. The annular sewing ring of claim 24, wherein the collagen is selected from the group consisting of collagen type I, collagen type II, collagen type III, collagen type IV, collagen type V, collagen type VI, collagen type VII, collagen type VIII, collagen type IX, collagen type X, collagen type XI, collagen type XII, collagen type XIII, collagen type XIV, and collagen type XVII.

26. The annular sewing ring of claim 23, wherein the ring is seeded with cells which normally populate semilunar valve tissue.

27. The annular sewing ring of claim 23, wherein the ring is enriched with signaling molecules.

28. The annular sewing ring of claim 23, wherein the signaling molecules are selected from the group consisting of sonic hedgehog; NK-2, XNKx-3.3 (tinman), hCsx and Gax homeobox gene products; TGFbeta, VEGF, FGF, IGF, PDGF, and BMP4 cytokine proteins.

29. A semilunar heart valve made according to the method comprising the steps of:

(a) assembling a mold which replicates the structure of a semilunar heart valve having between two lateral edges a hollow representing the aortic root and hollows representing a plurality of leaflets with outer and inner surfaces, the inner surfaces connecting with the hollow representing the aortic root and forming the intimal surface of the hollow representing the aortic root;

(b) covering the intimal surface of the hollow representing the aortic root and the outside surface of the hollow representing the plurality of leaflets with a biopolymer fiber scaffold;

(c) filling the hollow representing the aortic root and the hollows representing the plurality of leaflets with collagen; and

(d) freeze-drying the biopolymer fiber scaffold and the liquid dense fibrillar collagen forming a tissue with two lateral edges.